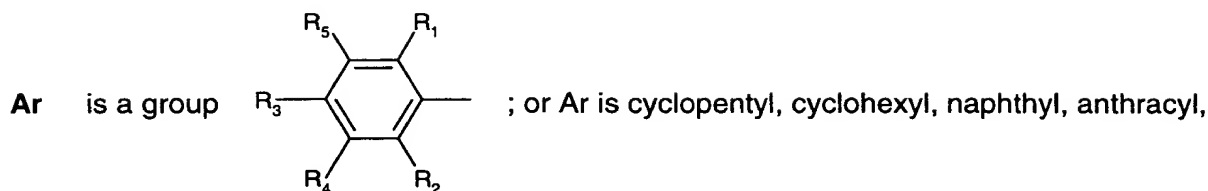
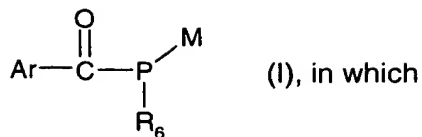


What is claimed is

- 1) A compound of the formula I



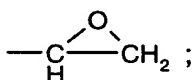
biphenyl or an O-, S- or N-containing 5- or 6-membered heterocyclic ring, where the radicals cyclopentyl, cyclohexyl, naphthyl, anthracyl, biphenyl and 5- or 6-membered heterocyclic ring are unsubstituted or substituted by halogen, C<sub>1</sub>-C<sub>4</sub>alkyl and/or C<sub>1</sub>-C<sub>4</sub>alkoxy;

R<sub>1</sub> and R<sub>2</sub> independently of one another are C<sub>1</sub>-C<sub>20</sub>alkyl, OR<sub>11</sub>, CF<sub>3</sub> or halogen;

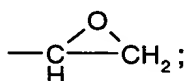
R<sub>3</sub>, R<sub>4</sub> and R<sub>5</sub> independently of one another are hydrogen, C<sub>1</sub>-C<sub>20</sub>alkyl, OR<sub>11</sub> or halogen;

or in each case two of the radicals R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub> and R<sub>5</sub> together form C<sub>1</sub>-C<sub>20</sub>alkylene, which can be interrupted by O, S or NR<sub>14</sub>;

R<sub>6</sub> is C<sub>1</sub>-C<sub>24</sub>alkyl, unsubstituted or substituted by cycloalkenyl, phenyl, CN, C(O)R<sub>11</sub>, C(O)OR<sub>11</sub>, C(O)N(R<sub>14</sub>)<sub>2</sub>, OC(O)R<sub>11</sub>, OC(O)OR<sub>11</sub>, N(R<sub>14</sub>)C(O)N(R<sub>14</sub>), OC(O)NR<sub>14</sub>,

N(R<sub>14</sub>)C(O)OR<sub>11</sub>, cycloalkyl, halogen, OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>) or ;

C<sub>2</sub>-C<sub>24</sub>alkyl which is interrupted once or more than once by nonconsecutive O, S or NR<sub>14</sub> and which is unsubstituted or substituted by phenyl, OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>), CN, C(O)R<sub>11</sub>,

C(O)OR<sub>11</sub>, C(O)N(R<sub>14</sub>)<sub>2</sub> and/or .

C<sub>2</sub>-C<sub>24</sub>alkenyl which is uninterrupted or interrupted once or more than once by nonconsecutive O, S or NR<sub>14</sub> and which is unsubstituted or substituted by OR<sub>11</sub>, SR<sub>11</sub> or N(R<sub>12</sub>)(R<sub>13</sub>);

C<sub>5</sub>-C<sub>24</sub>cycloalkenyl which is uninterrupted or interrupted once or more than once by nonconsecutive O, S or NR<sub>14</sub> and which is unsubstituted or substituted by OR<sub>11</sub>, SR<sub>11</sub> or N(R<sub>12</sub>)(R<sub>13</sub>);

C<sub>7</sub>-C<sub>24</sub>arylalkyl which is unsubstituted or substituted on the aryl group by C<sub>1</sub>-C<sub>12</sub>alkyl, C<sub>1</sub>-C<sub>12</sub>alkoxy or halogen;

C<sub>4</sub>-C<sub>24</sub>cycloalkyl which is uninterrupted or interrupted once or more than once by O, S and/or NR<sub>14</sub> and which is unsubstituted or substituted by OR<sub>11</sub>, SR<sub>11</sub> or N(R<sub>12</sub>)(R<sub>13</sub>); or C<sub>8</sub>-C<sub>24</sub>arylcyaloalkyl or C<sub>8</sub>-C<sub>24</sub>arylcyaloalkenyl;

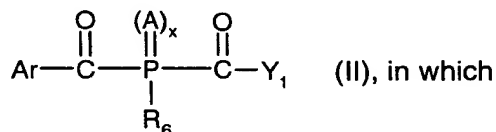
R<sub>11</sub> is H, C<sub>1</sub>-C<sub>20</sub>alkyl, C<sub>2</sub>-C<sub>20</sub>alkenyl, C<sub>3</sub>-C<sub>8</sub>cycloalkyl, phenyl, benzyl or C<sub>2</sub>-C<sub>20</sub>alkyl, which is interrupted once or more than once by O or S and which is unsubstituted or is substituted by OH and/or SH;

R<sub>12</sub> and R<sub>13</sub> independently of one another are hydrogen, C<sub>1</sub>-C<sub>20</sub>alkyl, C<sub>3</sub>-C<sub>8</sub>cycloalkyl, phenyl, benzyl or C<sub>2</sub>-C<sub>20</sub>alkyl which is interrupted once or more than once by nonconsecutive O atoms and which is unsubstituted or substituted by OH and/or SH; or R<sub>12</sub> and R<sub>13</sub> together are C<sub>3</sub>-C<sub>5</sub>alkylene which is uninterrupted or interrupted by O, S or NR<sub>14</sub>;

R<sub>14</sub> is hydrogen, phenyl, C<sub>1</sub>-C<sub>12</sub>alkyl or C<sub>2</sub>-C<sub>12</sub>alkyl which is interrupted once or more than once by O or S and which is unsubstituted or substituted by OH and/or SH; and

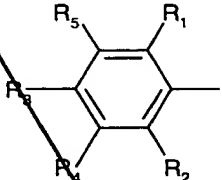
M is hydrogen, Li, Na or K.

2 A compound of the formula II



A is O or S;

x is 0 or 1;

Ar is a group ; or Ar is cyclopentyl, cyclohexyl, naphthyl, anthracyl,

biphenyl or an O-, S- or N-containing 5- or 6-membered heterocyclic ring, where the radicals cyclopentyl, cyclohexyl, naphthyl, anthracyl, biphenyl and 5- or 6-membered heterocyclic ring are unsubstituted or substituted by halogen, C<sub>1</sub>-C<sub>4</sub>alkyl and/or C<sub>1</sub>-C<sub>4</sub>alkoxy;

R<sub>1</sub> and R<sub>2</sub> independently of one another are C<sub>1</sub>-C<sub>20</sub>alkyl, OR<sub>11</sub>, CF<sub>3</sub> or halogen;

R<sub>3</sub>, R<sub>4</sub> and R<sub>5</sub> independently of one another are hydrogen, C<sub>1</sub>-C<sub>20</sub>alkyl, OR<sub>11</sub> or halogen;

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or in each case two of the radicals  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$  and  $R_5$  together form  $C_1$ - $C_{20}$ alkylene which can be interrupted by O, S or  $-NR_{14}$ ;

$R_6$  is  $C_1$ - $C_{24}$ alkyl, unsubstituted or substituted by  $C_5$ - $C_{24}$ cycloalkenyl, phenyl, CN,  $C(O)R_{11}$ ,  $C(O)OR_{11}$ ,  $C(O)N(R_{14})_2$ ,  $OC(O)R_{11}$ ,  $OC(O)OR_{11}$ ,  $N(R_{14})C(O)N(R_{14})$ ,  $OC(O)NR_{14}$ ,  $N(R_{14})C(O)OR_{11}$ , cycloalkyl, halogen,  $OR_{11}$ ,  $SR_{11}$ ,  $N(R_{12})(R_{13})$  or  $-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{CH}_2$  ;

$C_2$ - $C_{24}$ alkyl which is interrupted once or more than once by nonconsecutive O, S or  $NR_{14}$  and which is unsubstituted or substituted by phenyl,  $OR_{11}$ ,  $SR_{11}$ ,  $N(R_{12})(R_{13})$ , CN,  $C(O)R_{11}$ ,  $C(O)OR_{11}$ ,  $C(O)N(R_{14})_2$  and/or  $-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{CH}_2$  ;

$C_2$ - $C_{24}$ alkenyl which is uninterrupted or interrupted once or more than once by nonconsecutive O, S or  $NR_{14}$  and which is unsubstituted or substituted by  $OR_{11}$ ,  $SR_{11}$  or  $N(R_{12})(R_{13})$ ;

$C_5$ - $C_{24}$ cycloalkenyl which is uninterrupted or interrupted once or more than once by nonconsecutive O, S or  $NR_{14}$  and which is unsubstituted or substituted by  $OR_{11}$ ,  $SR_{11}$  or  $N(R_{12})(R_{13})$ ;

$C_7$ - $C_{24}$ arylalkyl which is unsubstituted or substituted on the aryl group by  $C_1$ - $C_{12}$ alkyl,  $C_1$ - $C_{12}$ alkoxy or halogen;

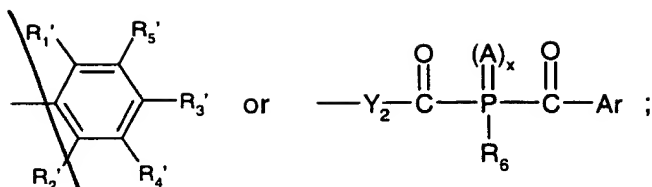
$C_4$ - $C_{24}$ cycloalkyl which is uninterrupted or interrupted once or more than once by O, S and/or  $NR_{14}$  and which is unsubstituted or substituted by  $OR_{11}$ ,  $SR_{11}$  or  $N(R_{12})(R_{13})$ ; or

$C_8$ - $C_{24}$ arylcycloalkyl or  $C_8$ - $C_{24}$ arylcycloalkenyl;

$R_{11}$  is H,  $C_1$ - $C_{20}$ alkyl,  $C_2$ - $C_{20}$ alkenyl,  $C_3$ - $C_8$ cycloalkyl, phenyl, benzyl or  $C_2$ - $C_{20}$ alkyl which is interrupted once or more than once by nonconsecutive O atoms and which is unsubstituted or substituted by OH and/or SH;

$R_{12}$  and  $R_{13}$  independently of one another are hydrogen,  $C_1$ - $C_{20}$ alkyl,  $C_3$ - $C_8$ cycloalkyl, phenyl, benzyl or  $C_2$ - $C_{20}$ alkyl which is interrupted once or more than once by O or S and which is unsubstituted or substituted by OH and/or SH; or  $R_{12}$  and  $R_{13}$  together are  $C_3$ - $C_5$ alkylene which is uninterrupted or interrupted by O, S or  $NR_{14}$ ;

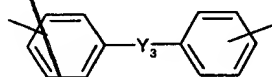
$Y_1$  is  $C_1$ - $C_{18}$ alkyl which is unsubstituted or substituted by one or more phenyl;  $C_1$ - $C_{18}$ halogenoalkyl;  $C_2$ - $C_{18}$ alkyl which is interrupted once or more than once by O or S and which can be substituted by OH and/or SH; unsubstituted  $C_3$ - $C_{18}$ cycloalkyl or  $C_3$ - $C_{18}$ cycloalkyl substituted by  $C_1$ - $C_{20}$ alkyl,  $OR_{11}$ ,  $CF_3$  or halogen;  $C_2$ - $C_{18}$ alkenyl; or  $Y_1$  is  $OR_{11}$ ,  $N(R_{12})(R_{13})$  or one of the radicals



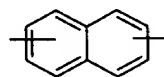
or  $Y_1$  is cyclopentyl, cyclohexyl, naphthyl, anthracyl, biphenyl or an O-, S- or N-containing 5- or 6-membered heterocyclic ring, where the radicals cyclopentyl, cyclohexyl, naphthyl, anthracyl, biphenyl and 5- or 6-membered heterocyclic ring are unsubstituted or substituted by halogen,  $C_1$ - $C_4$ alkyl and/or  $C_1$ - $C_4$ alkoxy;

$Y_2$  is a direct bond; unsubstituted or phenyl-substituted  $C_1$ - $C_{18}$ alkylene; unsubstituted  $C_4$ - $C_{18}$ -cycloalkylene or  $C_4$ - $C_{18}$ cycloalkylene substituted by  $C_1$ - $C_{12}$ alkyl,  $OR_{11}$ , halogen and/or phenyl; unsubstituted  $C_5$ - $C_{18}$ cycloalkenylene or  $C_5$ - $C_{18}$ cycloalkenylene substituted by  $C_1$ - $C_{12}$ alkyl,  $OR_{11}$ , halogen and/or phenyl; unsubstituted phenylene or phenylene substituted one to four times by  $C_1$ - $C_{12}$ alkyl,  $OR_{11}$ , halogen,  $-(CO)OR_{14}$ ,  $-(CO)N(R_{12})(R_{13})$  and/or phenyl;

or  $Y_2$  is a radical



or



, where these radicals are

unsubstituted or are substituted one to four times on one or both aromatic ring(s) by  $C_1$ - $C_{12}$ alkyl,  $OR_{11}$ , halogen and/or phenyl;

$Y_3$  is O, S, SO,  $SO_2$ ,  $CH_2$ ,  $C(CH_3)_2$ ,  $CHCH_3$ ,  $C(CF_3)_2$ , CO or a direct bond;

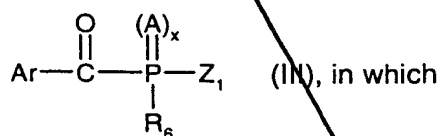
$R_{14}$  is hydrogen, phenyl,  $C_1$ - $C_{12}$ alkyl or  $C_2$ - $C_{12}$ alkyl which is interrupted once or more than once by O or S and which can be substituted by OH and/or SH;

$R_1'$  and  $R_2'$  independently of one another have the same meanings as given for  $R_1$  and  $R_2$ ; and

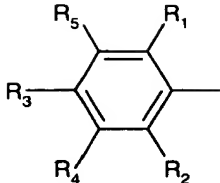
$R_3'$ ,  $R_4'$  and  $R_5'$  independently of one another have the same meanings as given for  $R_3$ ,  $R_4$  and  $R_5$ ;

or in each case two of the radicals  $R_1'$ ,  $R_2'$ ,  $R_3'$ ,  $R_4'$  and  $R_5'$  together form  $C_1$ - $C_{20}$ alkylene which may be interrupted by O, S or  $-NR_{14}$ , with the proviso that  $Y_1$  is not identical to Ar.

3. A compound of the formula III



**A** is O or S;  
**x** is 0 or 1;

**Ar** is a group ; or Ar is cyclopentyl, cyclohexyl, naphthyl, anthracyl,

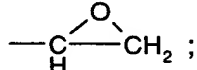
biphenyl or an O-, S- or N-containing 5- or 6-membered heterocyclic ring, where the radicals cyclopentyl, cyclohexyl, naphthyl, anthracyl, biphenyl and 5- or 6-membered heterocyclic ring are unsubstituted or substituted by halogen, C<sub>1</sub>-C<sub>4</sub>alkyl and/or C<sub>1</sub>-C<sub>4</sub>alkoxy;

**R<sub>1</sub>** and **R<sub>2</sub>** independently of one another are C<sub>1</sub>-C<sub>20</sub>alkyl, OR<sub>11</sub>, CF<sub>3</sub> or halogen;

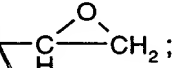
**R<sub>3</sub>**, **R<sub>4</sub>** and **R<sub>5</sub>** independently of one another are hydrogen, C<sub>1</sub>-C<sub>20</sub>alkyl, OR<sub>11</sub> or halogen;

or in each case two of the radicals **R<sub>1</sub>**, **R<sub>2</sub>**, **R<sub>3</sub>**, **R<sub>4</sub>** and **R<sub>5</sub>** together form C<sub>1</sub>-C<sub>20</sub>alkylene which can be interrupted by O, S or -NR<sub>14</sub>;

**R<sub>6</sub>** is C<sub>1</sub>-C<sub>24</sub>alkyl, unsubstituted or substituted by C<sub>5</sub>-C<sub>24</sub>cycloalkenyl, phenyl, CN, C(O)R<sub>11</sub>, C(O)OR<sub>11</sub>, C(O)N(R<sub>14</sub>)<sub>2</sub>, OC(O)R<sub>11</sub>, OC(O)OR<sub>11</sub>, N(R<sub>14</sub>)C(O)N(R<sub>14</sub>), OC(O)NR<sub>14</sub>,

N(R<sub>14</sub>)C(O)OR<sub>11</sub>, cycloalkyl, halogen, OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>) or ;

C<sub>2</sub>-C<sub>24</sub>alkyl which is interrupted once or more than once by nonconsecutive O, S or NR<sub>14</sub> and which is unsubstituted or substituted by phenyl, OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>), CN, C(O)R<sub>11</sub>,

C(O)OR<sub>11</sub>, C(O)N(R<sub>14</sub>)<sub>2</sub> and/or ;

C<sub>2</sub>-C<sub>24</sub>alkenyl which is uninterrupted or interrupted once or more than once by nonconsecutive O, S or NR<sub>14</sub> and which is unsubstituted or substituted by OR<sub>11</sub>, SR<sub>11</sub> or N(R<sub>12</sub>)(R<sub>13</sub>);

C<sub>5</sub>-C<sub>24</sub>cycloalkenyl which is uninterrupted or interrupted once or more than once by nonconsecutive O, S or NR<sub>14</sub> and which is unsubstituted or substituted by OR<sub>11</sub>, SR<sub>11</sub> or N(R<sub>12</sub>)(R<sub>13</sub>);

C<sub>7</sub>-C<sub>24</sub>arylalkyl which is unsubstituted or substituted on the aryl group by C<sub>1</sub>-C<sub>12</sub>alkyl, C<sub>1</sub>-C<sub>12</sub>alkoxy or halogen;

C<sub>4</sub>-C<sub>24</sub>cycloalkyl which is uninterrupted or interrupted once or more than once by O, S and/or NR<sub>14</sub> and which is unsubstituted or substituted by OR<sub>11</sub>, SR<sub>11</sub> or N(R<sub>12</sub>)(R<sub>13</sub>); or

C<sub>8</sub>-C<sub>24</sub>arylalkyl or C<sub>8</sub>-C<sub>24</sub>arylalkenyl;

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$R_{11}$  is H,  $C_1$ - $C_{20}$ alkyl,  $C_2$ - $C_{20}$ alkenyl,  $C_3$ - $C_8$ cycloalkyl, phenyl, benzyl or  $C_2$ - $C_{20}$ alkyl which is interrupted once or more than once by nonconsecutive O atoms and which is unsubstituted or substituted by OH and/or SH;

$R_{12}$  and  $R_{13}$  independently of one another are hydrogen,  $C_1$ - $C_{20}$ alkyl,  $C_3$ - $C_8$ cycloalkyl, phenyl, benzyl or  $C_2$ - $C_{20}$ alkyl, which is interrupted once or more than once by O or S and which is unsubstituted or substituted by OH and/or SH; or  $R_{12}$  and  $R_{13}$  together are  $C_3$ - $C_5$ alkylene which is uninterrupted or interrupted by O, S or  $NR_{14}$ ;

$Z_1$  is  $C_1$ - $C_{24}$ alkyl, which is unsubstituted or substituted once or more than once by  $OR_{15}$ ,

$SR_{15}$ ,  $N(R_{16})(R_{17})$ , phenyl, halogen, CN,  $-N=C=A$ ,  $\begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{---C---CH}_2 \\ | \\ \text{H} \end{array}$ ,  $\begin{array}{c} \text{A} \\ || \\ \text{---C---R}_{18} \end{array}$ ,  $\begin{array}{c} \text{A} \\ || \\ \text{---C---OR}_{18} \end{array}$

and/or  $\begin{array}{c} \text{A}_1 \\ || \\ \text{---C---N(R}_{18})_2 \end{array}$  or  $Z_1$  is  $C_2$ - $C_{24}$ alkyl which is interrupted once or more than once by O, S or  $NR_{14}$  and which can be substituted by  $OR_{15}$ ,  $SR_{15}$ ,  $N(R_{16})(R_{17})$ , phenyl, halogen,

$\begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{---C---CH}_2 \\ | \\ \text{H} \end{array}$ ,  $\begin{array}{c} \text{A} \\ || \\ \text{---C---R}_{18} \end{array}$ ,  $\begin{array}{c} \text{A} \\ || \\ \text{---C---OR}_{18} \end{array}$  and/or  $\begin{array}{c} \text{A}_1 \\ || \\ \text{---C---N(R}_{18})_2 \end{array}$ ; or  $Z_1$  is  $C_1$ - $C_{24}$ alkoxy,

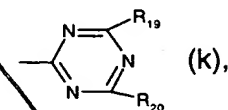
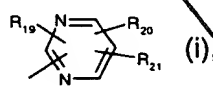
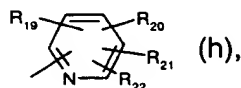
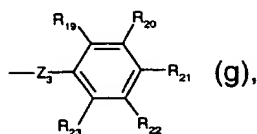
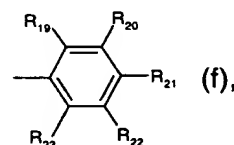
which is substituted once or more than once by phenyl, CN,  $-N=C=A$ ,  $\begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{---C---CH}_2 \\ | \\ \text{H} \end{array}$ ,

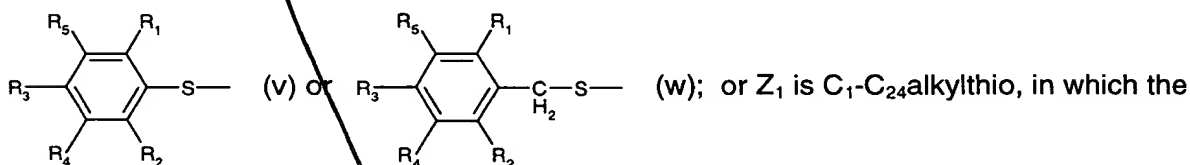
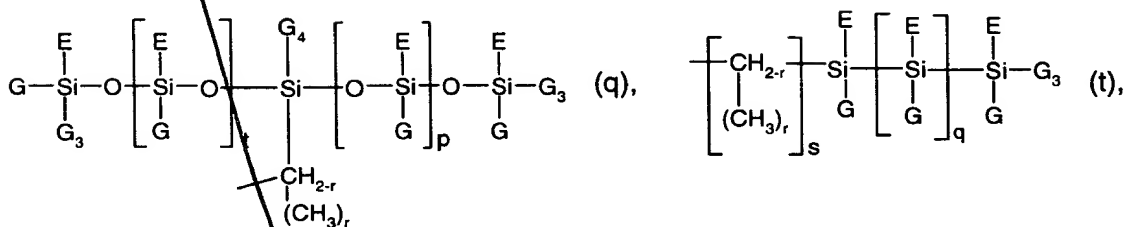
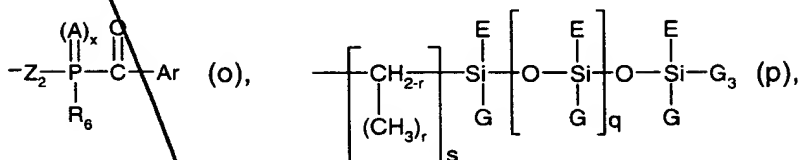
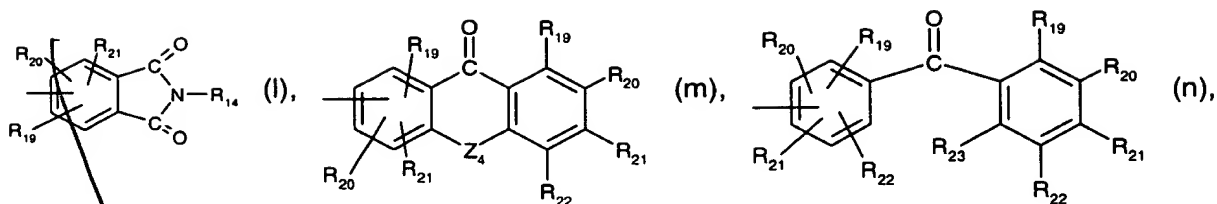
$\begin{array}{c} \text{A} \\ || \\ \text{---C---R}_{18} \end{array}$ ,  $\begin{array}{c} \text{A} \\ || \\ \text{---C---OR}_{18} \end{array}$  and/or  $\begin{array}{c} \text{A}_1 \\ || \\ \text{---C---N(R}_{18})_2 \end{array}$ ; or  $Z_1$  is  $\begin{array}{c} \text{A} \\ || \\ \text{---C---OR}_{11} \end{array}$ ,

$\begin{array}{c} \text{A}_1 \\ || \\ \text{---C---N(R}_{16})(R_{17}) \end{array}$ ,  $\begin{array}{c} \text{A} \\ || \\ \text{---C---OR}_{11a} \end{array}$  or  $\begin{array}{c} \text{A}_1 \\ || \\ \text{---C---N(R}_{18a})(R_{18b}) \end{array}$ ; or  $Z_1$  is unsubstituted

$C_3$ - $C_{24}$ cycloalkyl or  $C_3$ - $C_{24}$ cycloalkyl substituted by  $C_1$ - $C_{20}$ alkyl,  $OR_{11}$ ,  $CF_3$  or halogen; unsubstituted  $C_2$ - $C_{24}$ alkenyl or  $C_2$ - $C_{24}$ alkenyl substituted by  $C_6$ - $C_{12}$ aryl, CN,  $(CO)OR_{15}$  or

$(CO)N(R_{18})_2$ ; or  $Z_1$  is  $C_3$ - $C_{24}$ cycloalkenyl or is one of the radicals





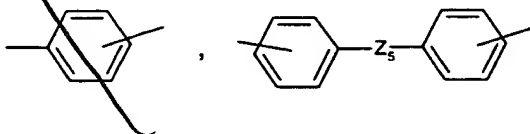
alkyl radical is uninterrupted or interrupted once or more than once by nonconsecutive O or S, and is unsubstituted or substituted by OR<sub>15</sub>, SR<sub>15</sub> and/or halogen; with the proviso that Z<sub>1</sub> and R<sub>6</sub> are not identical;

A<sub>1</sub> is O, S or NR<sub>18a</sub>;

Z<sub>2</sub> is C<sub>1</sub>-C<sub>24</sub>alkylene; C<sub>2</sub>-C<sub>24</sub>alkylene interrupted once or more than once by O, S or NR<sub>14</sub>; C<sub>2</sub>-C<sub>24</sub>alkenylene; C<sub>2</sub>-C<sub>24</sub>alkenylene interrupted once or more than once by O, S or NR<sub>14</sub>; C<sub>3</sub>-C<sub>24</sub>cycloalkylene; C<sub>3</sub>-C<sub>24</sub>cycloalkylene interrupted once or more than once by O, S or NR<sub>14</sub>; C<sub>3</sub>-C<sub>24</sub>cycloalkylene; C<sub>3</sub>-C<sub>24</sub>cycloalkenylene interrupted once or more than once by O, S or NR<sub>14</sub>;

where the radicals C<sub>1</sub>-C<sub>24</sub>alkylene, C<sub>2</sub>-C<sub>24</sub>alkylene, C<sub>2</sub>-C<sub>24</sub>alkenylene, C<sub>3</sub>-C<sub>24</sub>cycloalkylene and C<sub>3</sub>-C<sub>24</sub>cycloalkenylene are unsubstituted or are substituted by OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>)

and/or halogen; or Z<sub>2</sub> is one of the radicals



or  $\text{---Z}_6\text{---}$   , where these radicals are unsubstituted or are substituted on the

aromatic by C<sub>1</sub>-C<sub>20</sub>alkyl; C<sub>2</sub>-C<sub>20</sub>alkyl which is interrupted once or more than once by nonconsecutive O atoms and which is unsubstituted or substituted by OH and/or SH; OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>), phenyl, halogen, NO<sub>2</sub>, CN, (CO)-OR<sub>11</sub>, (CO)-R<sub>11</sub>, (CO)-N(R<sub>12</sub>)(R<sub>13</sub>), SO<sub>2</sub>R<sub>24</sub>, OSO<sub>2</sub>R<sub>24</sub>, CF<sub>3</sub> and/or CCl<sub>3</sub>;

or Z<sub>2</sub> is a group  $\left[ \begin{array}{c} \text{CH}_{2-r} \\ | \\ (\text{CH}_3)_r \end{array} \right]_s \text{---} \left[ \begin{array}{c} \text{E} \\ | \\ \text{Si} \\ | \\ \text{G} \end{array} \right] \text{---} \text{O} \text{---} \left[ \begin{array}{c} \text{E} \\ | \\ \text{Si} \\ | \\ \text{G} \end{array} \right]_q \text{---} \text{O} \text{---} \left[ \begin{array}{c} \text{E} \\ | \\ \text{Si} \\ | \\ \text{G} \end{array} \right] \text{---} \left[ \begin{array}{c} \text{CH}_{2-r} \\ | \\ (\text{CH}_3)_r \end{array} \right]_s$  (r) or

$\left[ \begin{array}{c} \text{CH}_{2-r} \\ | \\ (\text{CH}_3)_r \end{array} \right]_s \text{---} \left[ \begin{array}{c} \text{E} \\ | \\ \text{Si} \\ | \\ \text{G} \end{array} \right]_q \text{---} \left[ \begin{array}{c} \text{E} \\ | \\ \text{Si} \\ | \\ \text{G} \end{array} \right] \text{---} \left[ \begin{array}{c} \text{CH}_{2-r} \\ | \\ (\text{CH}_3)_r \end{array} \right]_s$  (u);

Z<sub>3</sub> is CH<sub>2</sub>, CH(OH), CH(CH<sub>3</sub>) or C(CH<sub>3</sub>)<sub>2</sub>;

Z<sub>4</sub> is S, O, CH<sub>2</sub>, C=O, NR<sub>14</sub> or a direct bond;

Z<sub>5</sub> is S, O, CH<sub>2</sub>, CHCH<sub>3</sub>, C(CH<sub>3</sub>)<sub>2</sub>, C(CF<sub>3</sub>)<sub>2</sub>, SO, SO<sub>2</sub>, CO;

Z<sub>6</sub> and Z<sub>7</sub> independently of one another are CH<sub>2</sub>, CHCH<sub>3</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

r is 0, 1 or 2;

s is a number from 1 to 12;

q is a number from 0 to 50;

t and p are each a number from 0 to 20;

E, G, G<sub>3</sub> and G<sub>4</sub> independently of one another are unsubstituted C<sub>1</sub>-C<sub>12</sub>alkyl or C<sub>1</sub>-C<sub>12</sub>alkyl substituted by halogen, or are unsubstituted phenyl or phenyl substituted by one or more C<sub>1</sub>-C<sub>4</sub>alkyl; or are C<sub>2</sub>-C<sub>12</sub>alkenyl;

R<sub>11a</sub> is C<sub>1</sub>-C<sub>20</sub>alkyl substituted once or more than once by OR<sub>15</sub> or  $\text{---}\overset{\text{O}}{\underset{\text{H}}{\text{C}}}\text{---CH}_2$ ; or is

C<sub>2</sub>-C<sub>20</sub>alkyl which is interrupted once or more than once by nonconsecutive O atoms and is unsubstituted or substituted once or more than once by OR<sub>15</sub>, halogen or  $\text{---}\overset{\text{O}}{\underset{\text{H}}{\text{C}}}\text{---CH}_2$ ; or R<sub>11a</sub> is

C<sub>2</sub>-C<sub>20</sub>alkenyl, C<sub>3</sub>-C<sub>12</sub>alkynyl; or R<sub>11a</sub> is C<sub>3</sub>-C<sub>12</sub>cycloalkenyl which is substituted once or

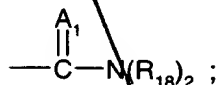
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more than once by halogen, NO<sub>2</sub>, C<sub>1</sub>-C<sub>6</sub>alkyl, OR<sub>11</sub> or C(O)OR<sub>18</sub>; or C<sub>7</sub>-C<sub>16</sub>arylalkyl or C<sub>8</sub>-C<sub>16</sub>arylcycloalkyl;

R<sub>14</sub> is hydrogen, phenyl, C<sub>1</sub>-C<sub>12</sub>alkoxy, C<sub>1</sub>-C<sub>12</sub>alkyl or C<sub>2</sub>-C<sub>12</sub>alkyl which is interrupted once or more than once by O or S and which is unsubstituted or substituted by OH and/or SH;

R<sub>15</sub> has one of the meanings given for R<sub>11</sub> or is a radical  $\text{---}\overset{\overset{\text{A}}{\parallel}}{\text{C}}\text{---R}_{18}$ ,  $\text{---}\overset{\overset{\text{A}}{\parallel}}{\text{C}}\text{---OR}_{18}$  or



R<sub>16</sub> and R<sub>17</sub> independently of one another have one of the meanings given for R<sub>12</sub> or are a

radical  $\text{---}\overset{\overset{\text{A}}{\parallel}}{\text{C}}\text{---R}_{18}$ ,  $\text{---}\overset{\overset{\text{A}}{\parallel}}{\text{C}}\text{---OR}_{18}$  or  $\text{---}\overset{\overset{\text{A}}{\parallel}}{\text{C}}\text{---N(R}_{18}\text{)}_2$  ;

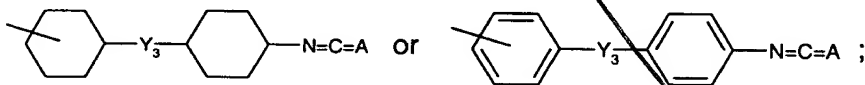
R<sub>18</sub> is hydrogen, C<sub>1</sub>-C<sub>24</sub>alkyl, C<sub>2</sub>-C<sub>12</sub>alkenyl, C<sub>3</sub>-C<sub>8</sub>cycloalkyl, phenyl, benzyl; C<sub>2</sub>-C<sub>20</sub>alkyl which is interrupted once or more than once by O or S and which is unsubstituted or substituted by OH;

R<sub>18a</sub> and R<sub>18b</sub> independently of one another are hydrogen; C<sub>1</sub>-C<sub>20</sub>alkyl, which is substituted once or more than once by OR<sub>15</sub>, halogen, styryl, methylstyryl, -N=C=A or  $\text{---}\overset{\overset{\text{O}}{\parallel}}{\text{C}}\text{---CH}_2$  ; or

C<sub>2</sub>-C<sub>20</sub>alkyl, which is interrupted once or more than once by nonconsecutive O atoms and which is unsubstituted or substituted once or more than once by OR<sub>15</sub>, halogen, styryl,

methylstyryl or  $\text{---}\overset{\overset{\text{O}}{\parallel}}{\text{C}}\text{---CH}_2$  ; or R<sub>18a</sub> and R<sub>18b</sub> are C<sub>2</sub>-C<sub>12</sub>alkenyl; C<sub>5</sub>-C<sub>12</sub>cycloalkyl, which is

substituted by -N=C=A or -CH<sub>2</sub>-N=C=A and is additionally unsubstituted or substituted by one or more C<sub>1</sub>-C<sub>4</sub>alkyl; or R<sub>18a</sub> and R<sub>18b</sub> are C<sub>6</sub>-C<sub>12</sub>aryl, unsubstituted or substituted once or more than once by halogen, NO<sub>2</sub>, C<sub>1</sub>-C<sub>6</sub>alkyl, C<sub>2</sub>-C<sub>4</sub>alkenyl, OR<sub>11</sub>, -N=C=A, -CH<sub>2</sub>-N=C=A or C(O)OR<sub>18</sub>; or R<sub>18a</sub> and R<sub>18b</sub> are C<sub>7</sub>-C<sub>16</sub>arylalkyl; or R<sub>18a</sub> and R<sub>18b</sub> together are C<sub>8</sub>-C<sub>16</sub>arylcycloalkyl; or R<sub>18a</sub> and R<sub>18b</sub> independently of one another are



Y<sub>3</sub> is O, S, SO, SO<sub>2</sub>, CH<sub>2</sub>, C(CH<sub>3</sub>)<sub>2</sub>, CHCH<sub>3</sub>, C(CF<sub>3</sub>)<sub>2</sub>, (CO), or a direct bond;

R<sub>19</sub>, R<sub>20</sub>, R<sub>21</sub>, R<sub>22</sub> and R<sub>23</sub> independently of one another are hydrogen, C<sub>1</sub>-C<sub>20</sub>alkyl; C<sub>2</sub>-C<sub>20</sub>alkyl, which is interrupted once or more than once by nonconsecutive O atoms and which is unsubstituted or substituted by OH and/or SH; or R<sub>19</sub>, R<sub>20</sub>, R<sub>21</sub>, R<sub>22</sub> and R<sub>23</sub> are

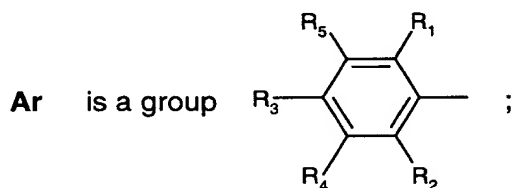
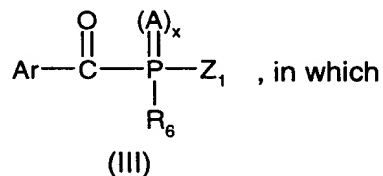
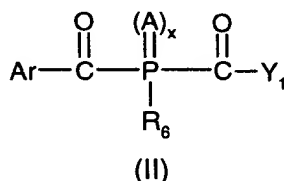
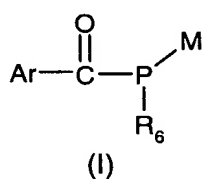
OR<sub>11</sub>, SR<sub>11</sub>, N(R<sub>12</sub>)(R<sub>13</sub>), NO<sub>2</sub>, CN, SO<sub>2</sub>R<sub>24</sub>, OSO<sub>2</sub>R<sub>24</sub>, CF<sub>3</sub>, CCl<sub>3</sub>, halogen; or phenyl which is unsubstituted or substituted once or more than once by C<sub>1</sub>-C<sub>4</sub>alkyl or C<sub>1</sub>-C<sub>4</sub>alkoxy;

or in each case two of the radicals R<sub>19</sub>, R<sub>20</sub>, R<sub>21</sub>, R<sub>22</sub> and R<sub>23</sub> together form C<sub>1</sub>-C<sub>20</sub>alkylene which is uninterrupted or interrupted by O, S or -NR<sub>14</sub>;

R<sub>24</sub> is C<sub>1</sub>-C<sub>12</sub>alkyl, halogen-substituted C<sub>1</sub>-C<sub>12</sub>alkyl, phenyl, or phenyl substituted by OR<sub>11</sub> and/or SR<sub>11</sub>;

with the proviso that R<sub>6</sub> and Z<sub>1</sub> are not identical.

4. A compound of the formula I, II or III



R<sub>1</sub> and R<sub>2</sub> independently of one another are C<sub>1</sub>-C<sub>8</sub>alkyl or OR<sub>11</sub> ;

R<sub>3</sub>, R<sub>4</sub> and R<sub>5</sub> independently of one another are hydrogen or C<sub>1</sub>-C<sub>8</sub>alkyl;

R<sub>6</sub> is C<sub>1</sub>-C<sub>12</sub>alkyl;

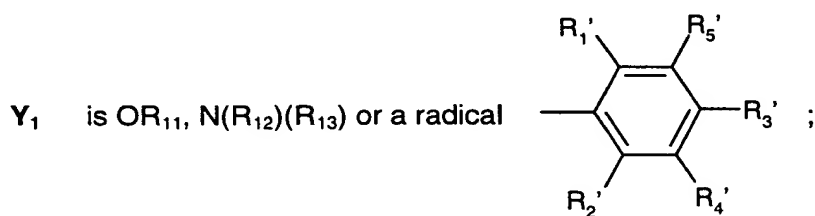
R<sub>11</sub> is H or C<sub>1</sub>-C<sub>8</sub>alkyl;

R<sub>12</sub> and R<sub>13</sub> independently of one another are hydrogen or C<sub>1</sub>-C<sub>8</sub>alkyl;

M is hydrogen or Li;

A is O;

x is 1;



R<sub>1</sub>' and R<sub>2</sub>' independently of one another have the same meanings given for R<sub>1</sub> and R<sub>2</sub>; and

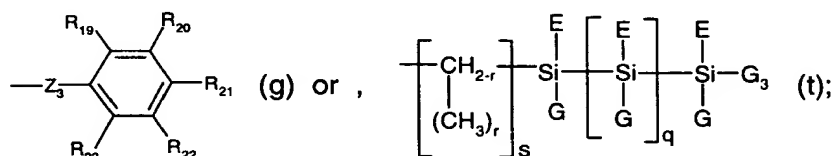
$R_3'$ ,  $R_4'$  and  $R_5'$  independently of one another have the same meanings as given for  $R_3$ ,  $R_4$  and  $R_5$ ;

with the proviso that  $Y_1$  is not identical to Ar;

$Z_1$  is  $C_1$ - $C_{12}$ alkyl which is unsubstituted or substituted once or more than once by  $OR_{15}$ ,

phenyl and/or  $\text{---}\overset{\text{A}}{\underset{\text{||}}{\text{C}}}\text{---}OR_{18}$ ; or  $Z_1$  is unsubstituted or  $OR_{11}$ -substituted  $C_3$ - $C_{24}$ cycloalkyl; or

$Z_1$  is one of the radicals



$Z_3$  is  $CH_2$  or  $CH(OH)$ ;

$r$  is 0;

$s$  is 1;

$E$ ,  $G$  and  $G_3$  independently of one another are unsubstituted  $C_1$ - $C_4$ alkyl;

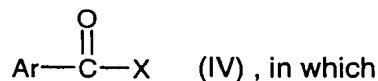
$R_{15}$  has one of the meanings given for  $R_{11}$ ;

$R_{18}$  is  $C_1$ - $C_{12}$ alkyl; and

$R_{19}$ ,  $R_{20}$ ,  $R_{21}$ ,  $R_{22}$  and  $R_{23}$  independently of one another are hydrogen or halogen; and with the proviso that  $R_6$  and  $Z_1$  are not identical.

5. / A process for the selective preparation of compounds of the formula I according to claim 1, by

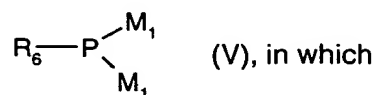
(1) reaction of an acyl halide of the formula IV



Ar is as defined in claim 1, and

X is Cl or Br;

with a dimetalated organophosphine of the formula V



$R_6$  is as defined in claim 1; and

$M_1$  is Na, Li or K;

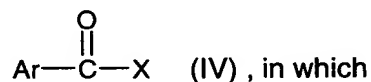
in the molar ratio 1:1; and

(2) where appropriate, subsequent hydrolysis of compounds of the formula I in which M is hydrogen are to be obtained.

6. The use of compounds of the formula I as starting materials for the preparation of mono- or bisacylphosphines, mono- or bisacylphosphine oxides or mono- or bisacylphosphine sulfides.

7. A process for the preparation of compounds of the formula II according to claim 2 by

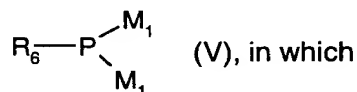
(1) reaction of an acyl halide of the formula IV



Ar is as defined in claim 2, and

X is Cl or Br;

with a dimetalated organophosphine of the formula V

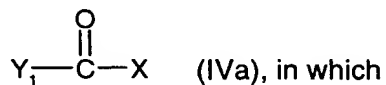


$R_6$  is as defined in claim 2; and

$M_1$  is Na, Li or K;

in the molar ratio of approximately 1:1;

(2) subsequent reaction of the product with an acyl halide of the formula IVa



$Y_1$  is as defined in claim 2; and

X is as defined above;

with the proviso that the acyl halide of the formula IV is not identical to the acyl halide of the formula IVa;

in the molar ratio of approximately 1:1; and,

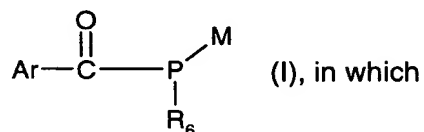
(3) if compounds of the formula II, in which A is oxygen or sulfur are to be obtained, subsequent oxidation or sulfurization of the phosphine compounds.

sub  
A<sub>1</sub>

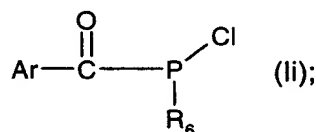
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8. A process for the preparation of compounds of the formula II according to claim 2, in which A is oxygen and x is 1, by

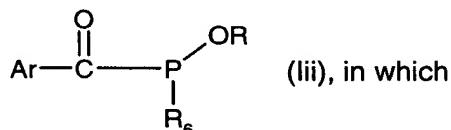
(1) reaction of a compound of the formula (I), according to claim 1



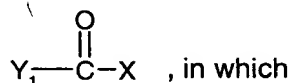
Ar, M and R<sub>6</sub> are as defined in claim 1,  
with phosgene to give the corresponding phosphine chloride (II)



(2) subsequent reaction with an alcohol to give the compound of the formula (III)



R is the radical of an alcohol, in particular C<sub>1</sub>-C<sub>12</sub>alkyl, C<sub>5</sub>-C<sub>8</sub>cycloalkyl or benzyl; and  
(3) reaction of the resulting compound of the formula (III) with an acyl halide



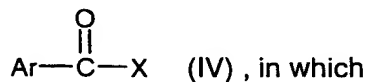
Y<sub>1</sub> is as defined in claim 2, and

X is Cl or Br,

to give the compound of the formula II but in which Ar and Y<sub>1</sub> are not necessarily different.

9. A process for the preparation of compounds of the formula III

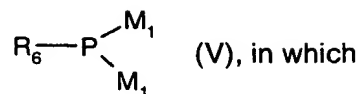
(1) by reaction of an acyl halide of the formula IV



Ar is as defined in claim 3, and

X is Cl or Br;

with a dimetalated organophosphine of the formula V

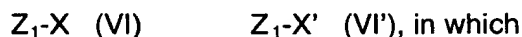


$\text{R}_6$  is as defined in claim 3; and

$\text{M}_1$  is Na, Li or K;

in the molar ratio of approximately 1:1;

(2) subsequent reaction of the product with a compound of the formula VI or VI'



$\text{Z}_1$  is as defined in claim 3 ; and

$\text{X}$  is as defined above; and

$\text{X}'$  is  $-\text{N}=\text{C}=\text{A}$ ,  $-\text{N}=\text{C}=\text{N}=\text{Z}_1$ ,  $-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{CH}_2$  or  $-\text{CHO}$ ;

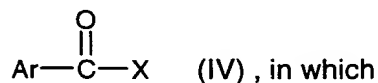
with the proviso that,  $\text{Z}_1$  is not identical to  $\text{R}_6$ ;

in the molar ratio of approximately 1:1; and, in the case where  $\text{Z}_1$  is not a group (v), (w) or  $\text{C}_1\text{-C}_{12}$ alkylthio, and

(3) compounds of the formula III, in which A is oxygen or sulfur are to be obtained, subsequent oxidation or sulfurization of the resulting phosphine compounds.

10. A process for the preparation of compounds of the formula III, according to claim 3,

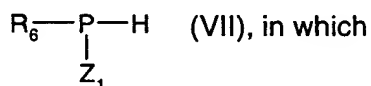
(1) by reaction of an acyl halide of the formula IV



$\text{Ar}$  is as defined in claim 1, and

$\text{X}$  is Cl or Br;

with an unsymmetrical phosphine of the formula VII



$\text{R}_6$  is as defined in claim 1, and

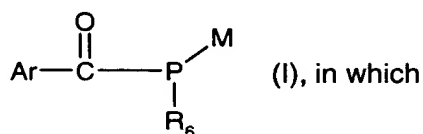
$\text{Z}_1$  is as defined in claim 3 with the proviso that  $\text{R}_6$  and  $\text{Z}_1$  are not identical;

in the molar ratio of approximately 1:1, in the presence of a base or an organolithium compound, to give the corresponding acylphosphine; and

(2) subsequent oxidation or sulfurization of the thus obtained acylphosphine.

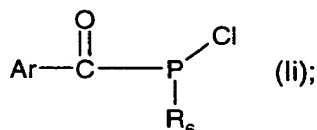
11. A process for the preparation of compounds of the formula III according to claim 3, in which A is oxygen and x is 1, by

(1) reaction of the compound of the formula (I), according to claim 1

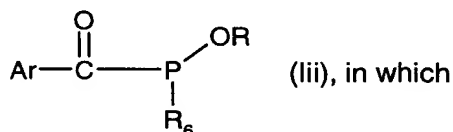


Ar, M and R<sub>6</sub> is as defined in claim 1,

with phosgene to give the corresponding phosphine chloride (II)



(2) subsequent reaction with an alcohol to give the compound of the formula (III)



R is the radical of an alcohol, in particular C<sub>1</sub>-C<sub>12</sub>alkyl, C<sub>5</sub>-C<sub>8</sub>cycloalkyl or benzyl; and

(3) reaction of the resulting compound of the formula (III) with an organoylhalide

Z<sub>1</sub>-X, in which

Z<sub>1</sub> is as defined in claim 3, but is not identical to R<sub>6</sub> from the formula (I) ist, and

X is Cl or Br,

to give the compound of the formula III.

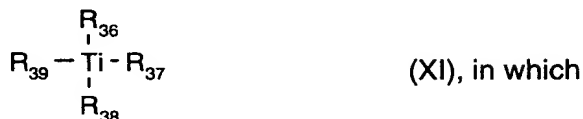
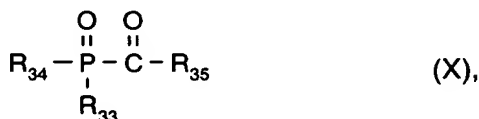
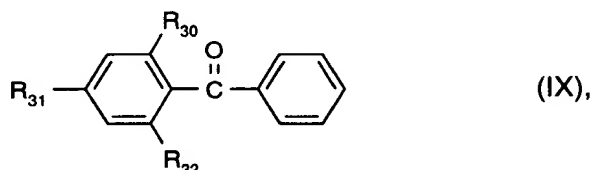
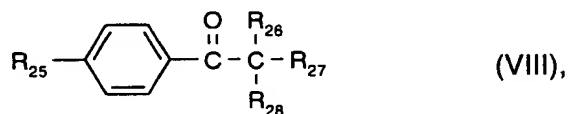
12. A photocurable composition comprising

- (a) at least one ethylenically unsaturated photopolymerizable compound and  
(b) at least one compound of the formula II or III as photoinitiator.

13. A photocurable composition according to claim 12, comprising, in addition to components (a) and (b), further photoinitiators (c) and/or further additives (d).

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14. A photocurable composition as claimed in claim 13, comprising, as further photoinitiator (c), at least one compound of the formula VIII, IX, X, XI



$\text{R}_{25}$  is hydrogen,  $\text{C}_1\text{-C}_{18}$ alkyl,  $\text{C}_1\text{-C}_{18}$ alkoxy,  $-\text{OCH}_2\text{CH}_2\text{-OR}_{29}$ , morpholino,  $\text{SCH}_3$ ,

a group  $\text{H}_2\text{C}=\text{C}(\text{CH}_3)-$  or a group  $\text{G}_1-\left[\text{CH}_2-\text{C}(\text{CH}_3)\right]_n-\text{G}_2$  ;

$n$  has a value from 2 to 10;

$\text{G}_1$  and  $\text{G}_2$  independently of one another are end groups of the polymeric unit, in particular hydrogen or  $\text{CH}_3$ ;

$\text{R}_{26}$  is hydroxyl,  $\text{C}_1\text{-C}_{16}$ alkoxy, morpholino, dimethylamino or  $-\text{O}(\text{CH}_2\text{CH}_2\text{O})_m\text{-C}_1\text{-C}_{16}$ alkyl;

$\text{R}_{27}$  and  $\text{R}_{28}$  independently of one another are hydrogen,  $\text{C}_1\text{-C}_6$ alkyl, phenyl, benzyl,  $\text{C}_1\text{-C}_{16}$ alkoxy or  $-\text{O}(\text{CH}_2\text{CH}_2\text{O})_m\text{-C}_1\text{-C}_{16}$ alkyl, or  $\text{R}_{27}$  and  $\text{R}_{28}$  together with the carbon atom to which they are bonded form a cyclohexyl ring;

$m$  is a number from 1-20;

where  $\text{R}_{26}$ ,  $\text{R}_{27}$  and  $\text{R}_{28}$  are not all  $\text{C}_1\text{-C}_{16}$ alkoxy or  $-\text{O}(\text{CH}_2\text{CH}_2\text{O})_m\text{-C}_1\text{-C}_{16}$ alkyl at the same time, and

$\text{R}_{29}$  is hydrogen,  $-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$  or  $-\text{C}(=\text{O})-\text{C}(\text{CH}_3)=\text{CH}_2$  ;



**R<sub>30</sub>** and **R<sub>32</sub>** independently of one another are hydrogen or methyl;

**R<sub>31</sub>** is hydrogen, methyl or phenylthio, where the phenyl ring of the phenylthio radical is unsubstituted or substituted by C<sub>1</sub>-C<sub>4</sub>alkyl in the 4-, 2-, 2,4- or 2,4,6-position;

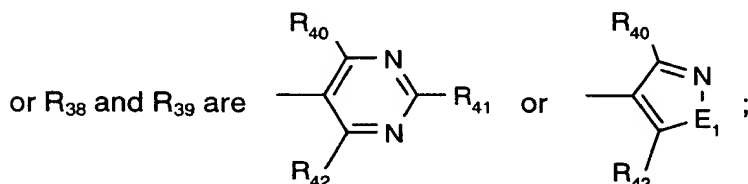
**R<sub>33</sub>** and **R<sub>34</sub>** independently of one another are C<sub>1</sub>-C<sub>20</sub>alkyl, cyclohexyl, cyclopentyl, phenyl, naphthyl or biphenyl, where these radicals are unsubstituted or are substituted by halogen, C<sub>1</sub>-C<sub>12</sub>alkyl and/or C<sub>1</sub>-C<sub>12</sub>alkoxy, or **R<sub>33</sub>** is an S- or N-containing 5- or 6-membered

heterocyclic ring, or are  $\text{—}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{—R}_{35}$  ;

**R<sub>35</sub>** is cyclohexyl, cyclopentyl, phenyl, naphthyl or biphenyl, these radicals being unsubstituted or substituted by halogen, C<sub>1</sub>-C<sub>4</sub>alkyl and/or C<sub>1</sub>-C<sub>4</sub>alkoxy, or **R<sub>35</sub>** is an S- or N-containing 5- or 6-membered heterocyclic ring;

**R<sub>36</sub>** and **R<sub>37</sub>** independently of one another are unsubstituted cyclopentadienyl or cyclopentadienyl substituted once, twice or three times by C<sub>1</sub>-C<sub>18</sub>alkyl, C<sub>1</sub>-C<sub>18</sub>alkoxy, cyclopentyl, cyclohexyl or halogen; and

**R<sub>38</sub>** and **R<sub>39</sub>** independently of one another are phenyl which is substituted in at least one of the two ortho positions relative to the titanium-carbon bond by fluorine atoms or CF<sub>3</sub>, and which on the aromatic ring may contain, as further substituents, unsubstituted pyrrolinyl or pyrrolinyl substituted by one or two C<sub>1</sub>-C<sub>12</sub>alkyl, di(C<sub>1</sub>-C<sub>12</sub>alkyl)aminomethyl, morpholinomethyl, C<sub>2</sub>-C<sub>4</sub>alkenyl, methoxymethyl, ethoxymethyl, trimethylsilyl, formyl, methoxy or phenyl; or polyoxaalkyl,



**R<sub>40</sub>**, **R<sub>41</sub>** and **R<sub>42</sub>** independently of one another are hydrogen, halogen, C<sub>2</sub>-C<sub>12</sub>alkenyl, C<sub>1</sub>-C<sub>12</sub>alkoxy, C<sub>2</sub>-C<sub>12</sub>alkoxy interrupted by one to four O atoms, cyclohexyloxy, cyclopentyloxy, phenoxy, benzyloxy, unsubstituted phenyl or phenyl substituted by C<sub>1</sub>-C<sub>4</sub>alkoxy, halogen, phenylthio or C<sub>1</sub>-C<sub>4</sub>-alkylthio; or biphenyl,

